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(54) **COMMUNICATION DEVICE AND CONTROL METHOD THEREOF**

(71) Applicant: **CANON KABUSHIKI KAISHA**, Tokyo (JP)

(72) Inventors: **Kentarou Midorikawa**, Yokohama (JP); **Junji Takai**, Yokohama (JP)

(73) Assignee: **CANON KABUSHIKI KAISHA** (JP)

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H04N 5/225 (2006.01)
H04N 5/232 (2006.01)

(52) **U.S. Cl.**
CPC ***H04N 5/2256*** (2013.01); ***H04N 5/23203*** (2013.01)

(58) **Field of Classification Search**
CPC H04N 5/23203; H04N 5/23206; H04N 5/23209; H04N 5/2256; H04N 5/2354
USPC 348/370–371
See application file for complete search history.

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Primary Examiner — Timothy J Henn
(74) *Attorney, Agent, or Firm* — Rossi, Kimms & McDowell LLP

(57) **ABSTRACT**

A communication device capable of preventing a failure in light emission control caused due to communication with a lighting device such as the master and the slave. The communication device is capable of connecting to an image pickup device and transmits a lighting instruction from the image pickup device to a lighting device through a communication unit capable of performing bidirectional communication. It is determined whether or not the lighting device is ready for lighting. The lighting device is prevented from transmitting information to the communication unit when the lighting device is ready for lighting.

13 Claims, 5 Drawing Sheets

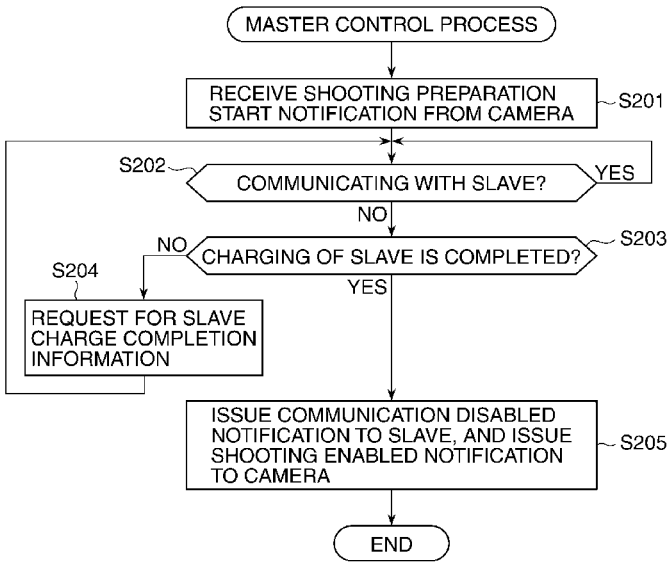


FIG.1

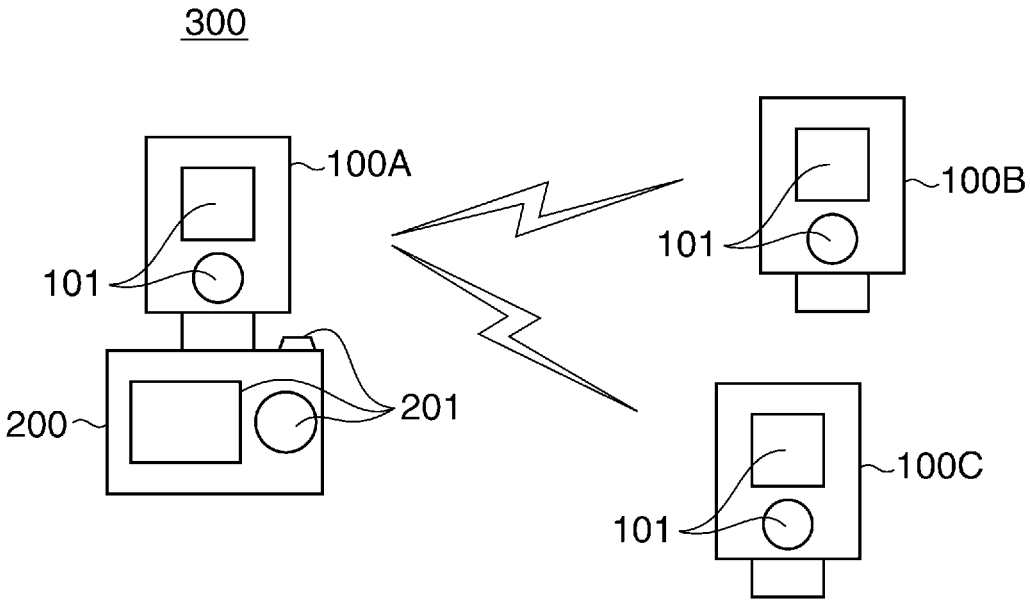


FIG.2

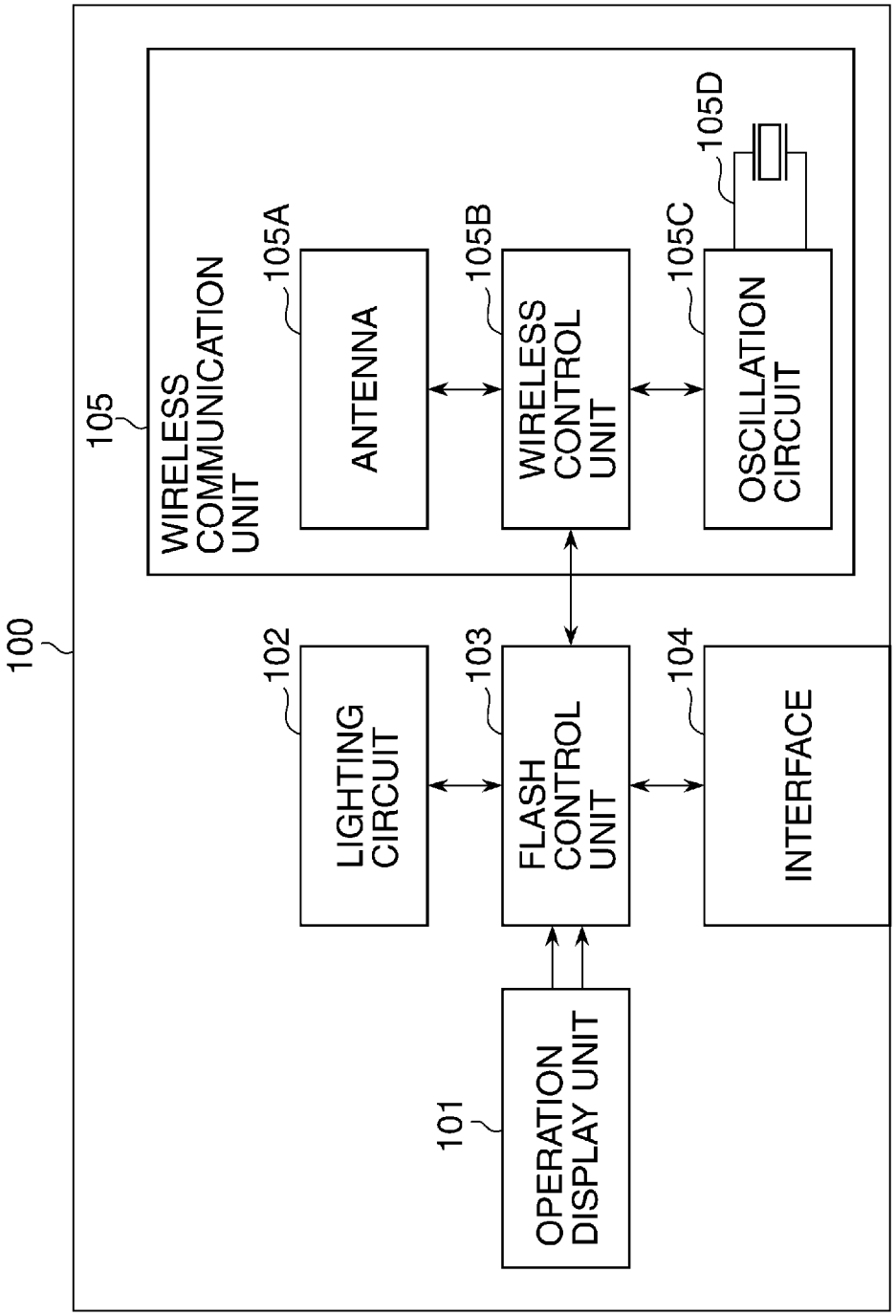

100
105
WIRELESS COMMUNICATION UNIT
105A
ANTENNA
105B
WIRELESS CONTROL UNIT
105C
OSCILLATION CIRCUIT
105D
102
LIGHTING CIRCUIT
103
FLASH CONTROL UNIT
104
INTERFACE
101
OPERATION DISPLAY UNIT

FIG.3

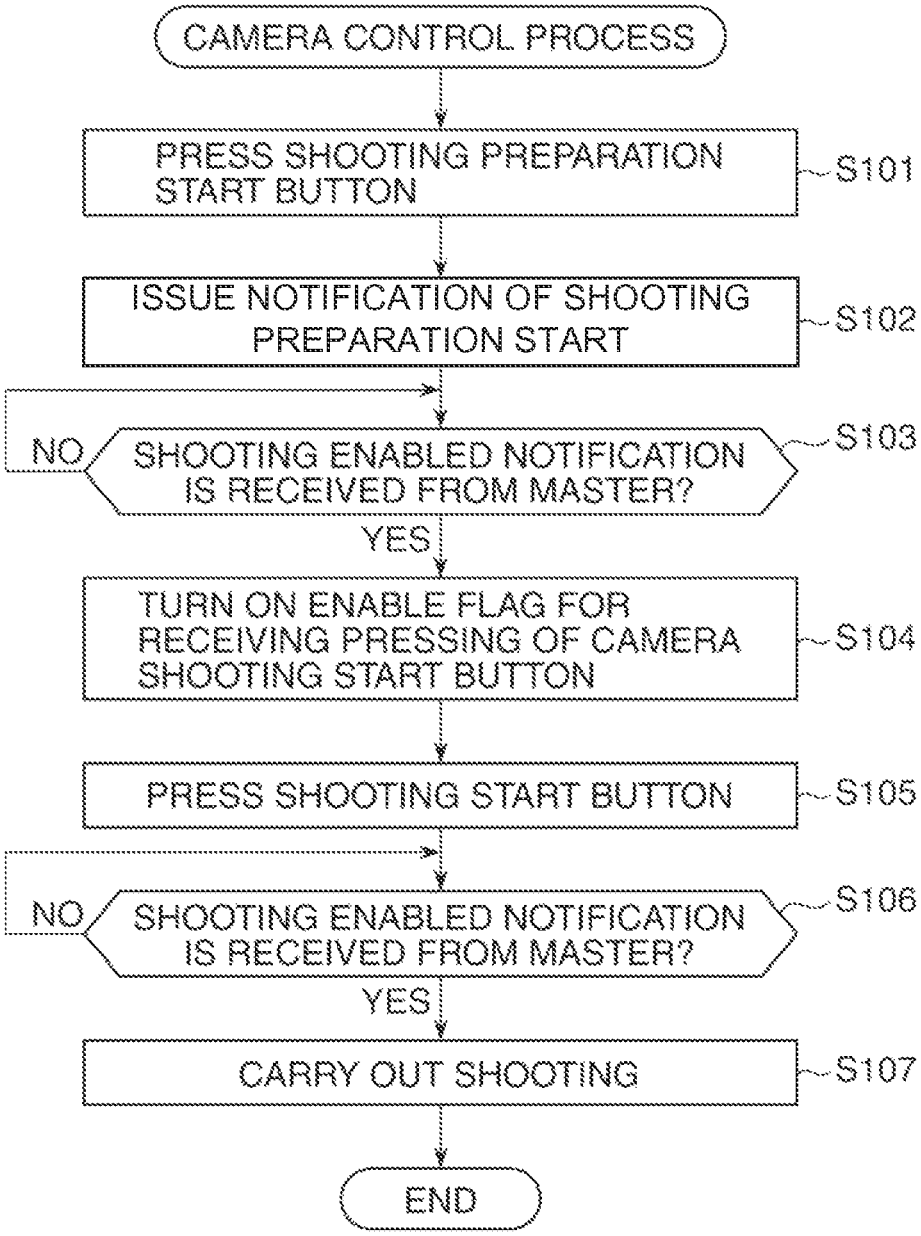

CAMERA CONTROL PROCESS
PRESS SHOOTING PREPARATION START BUTTON
S101
ISSUE NOTIFICATION OF SHOOTING PREPARATION START
S102
NO
SHOOTING ENABLED NOTIFICATION IS RECEIVED FROM MASTER?
S103
YES
TURN ON ENABLE FLAG FOR RECEIVING PRESSING OF CAMERA SHOOTING START BUTTON
S104
PRESS SHOOTING START BUTTON
S105
NO
SHOOTING ENABLED NOTIFICATION IS RECEIVED FROM MASTER?
S106
YES
CARRY OUT SHOOTING
S107
END

FIG.4

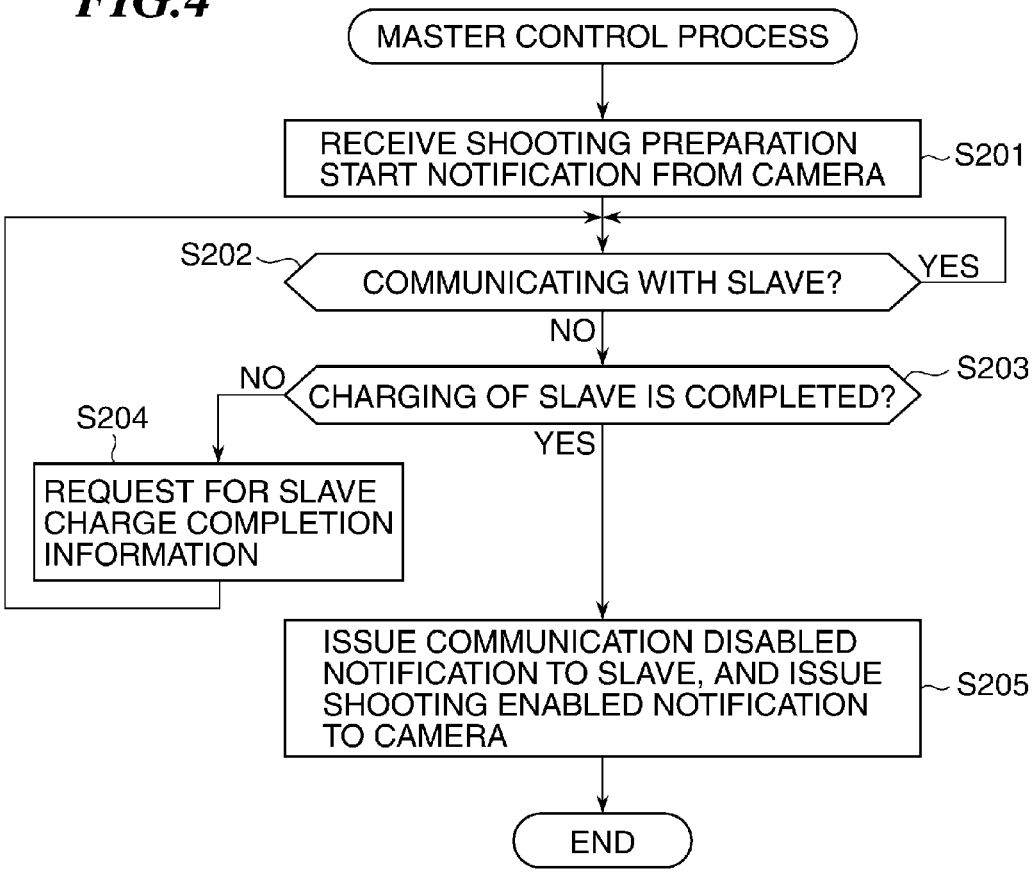

MASTER CONTROL PROCESS
RECEIVE SHOOTING PREPARATION START NOTIFICATION FROM CAMERA
S201
S202
COMMUNICATING WITH SLAVE?
YES
NO
NO
CHARGING OF SLAVE IS COMPLETED?
S203
S204
YES
REQUEST FOR SLAVE CHARGE COMPLETION INFORMATION
ISSUE COMMUNICATION DISABLED NOTIFICATION TO SLAVE, AND ISSUE SHOOTING ENABLED NOTIFICATION TO CAMERA
S205
END

FIG.5

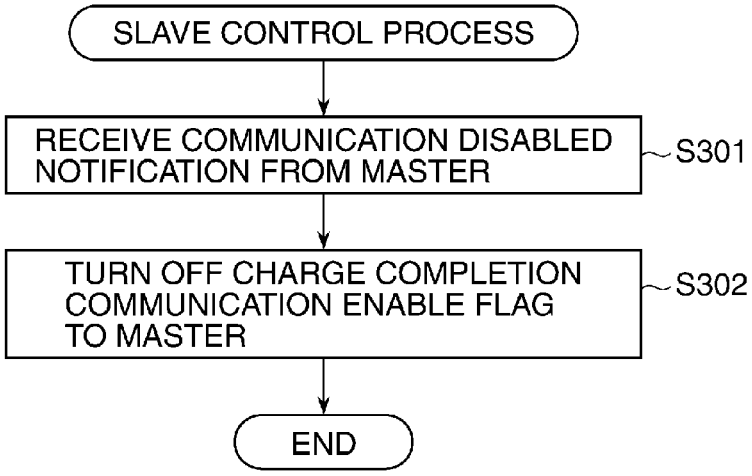
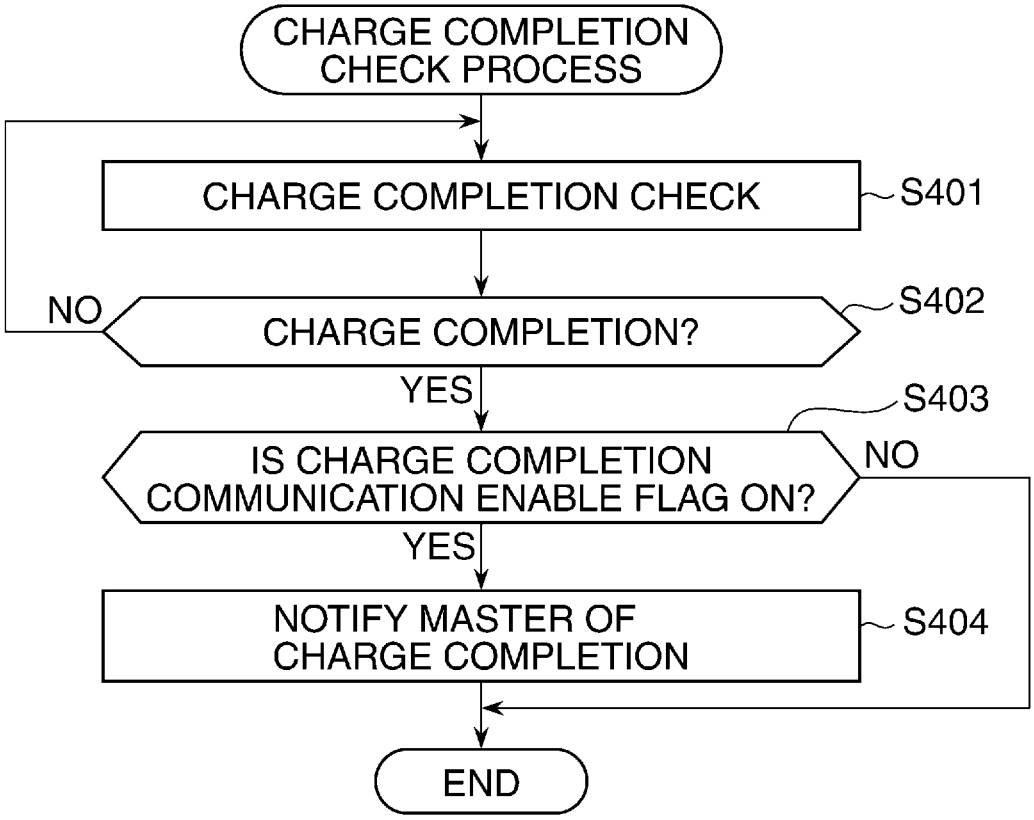

SLAVE CONTROL PROCESS
RECEIVE COMMUNICATION DISABLED NOTIFICATION FROM MASTER
S301
TURN OFF CHARGE COMPLETION COMMUNICATION ENABLE FLAG TO MASTER
S302
END

FIG.6


CHARGE COMPLETION CHECK PROCESS
CHARGE COMPLETION CHECK
S401
NO
CHARGE COMPLETION?
S402
YES
S403
IS CHARGE COMPLETION COMMUNICATION ENABLE FLAG ON?
NO
YES
NOTIFY MASTER OF CHARGE COMPLETION
S404
END

COMMUNICATION DEVICE AND CONTROL METHOD THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a communication device and a control method thereof.

2. Description of the Related Art

A conventional camera system takes control of unidirectional communication from a master flash (hereinafter referred to as "the master" as occasion demands) to a slave flash (hereinafter referred to as "the slave" as occasion demands) through optical pulse communication, which disables slave information, such as charge completion information of the slave, to be acquired. Completion of charging of the slave is notified to a user by turning on of a charge complete lamp which is a slave main body member or issuance of an auxiliary light signal (see Japanese Laid-Open Patent Publication (Kokai) No. 2005-73201, for example).

Moreover, in recent years, spread of wireless communication devices capable of performing bidirectional communication enables, if a communication function is implemented in a flash, information to be acquired from a slave, and thus, a user can recognize the completion of charging of the flash through a display device of a camera main body or a master flash attached to the camera main body.

However, there is an issue regarding wireless communication that, in a case where release control communication from the master and slave information communication from the slave occur at the same time, interference of the communication interrupts transmission of the communication, which may disable slave light emission control to be appropriately performed.

SUMMARY OF THE INVENTION

The present invention provides a communication device and a control method thereof, which are capable of preventing a failure in light emission control caused due to communication with a lighting device such as the master and the slave.

In an aspect of the present invention, there is provided a communication device, capable of connecting to an image pickup device, that transmits a lighting instruction from the image pickup device to a lighting device through a communication unit capable of performing bidirectional communication, comprising: a determining unit configured to determine whether or not the lighting device is ready for lighting; and a control unit configured to control the lighting device and the connected image pickup device, wherein the control unit prevents the lighting device from transmitting information to the communication unit when the lighting device is ready for lighting.

According to the present invention, it is possible to prevent a failure in light emission control caused due to communication with a lighting device such as the master and the slave.

Further features and advantages of the present invention will become apparent from the following detailed description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view schematically showing a schematic configuration of a camera system according to an embodiment of the present invention.

FIG. **2** is a view schematically showing a configuration of a flash in FIG. **1**.

FIG. **3** is a flowchart showing the procedure of a camera control process implemented by a camera in FIG. **1**.

FIG. **4** is a flowchart showing the procedure of a master control process implemented by a master flash in FIG. **1**.

FIG. **5** is a flowchart showing the procedure of a slave control process implemented by a slave flash in FIG. **1**.

FIG. **6** is a flowchart showing the procedure of a charge completion check process implemented by the slave flash in FIG. **1**.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The present invention will now be described in detail with reference to the drawings.

FIG. **1** is a view schematically showing a schematic configuration of a camera system **300** according to an embodiment of the present invention.

In FIG. **1**, a camera system **300** is constructed of flashes **100**A, **100**B, and **100**C as a plurality (three in this view) of lighting devices, each of which emits light on a object, and a camera **200** as an image pickup device, and configures a multi-light control system.

The flash **100**A (a communication device), among the three flashes **100**A, **100**B, and **100**C, can be physically connected to the camera **200**, and configures a master flash (a master lighting device).

Meanwhile, the flashes **100**B and **100**C other than the flash **100**A operates as slave flashes. The flash **100**A performs communication with each of the flashes **100**B and **100**C. The flash **100**A also performs communication with the camera **200**. Hereinafter, a common explanation to be given for the flashes **100**A, **100**B, and **100**C will be referred to as "the flash(s) **100**". Also, the flash **100**A may be sometimes referred to as "the master", and the flashes **100**B and **100**C may be sometimes referred to as "the slaves". Moreover, the slave flashes may be configured as a single unit.

The flash **100** includes an operation display unit **101** for performing display and various settings regarding light emission. Also, the camera **200** includes an operation display unit **201** for performing release control, display and setting/switching of a camera shooting mode, and display of information about the slave flash.

Additionally, in FIG. **1**, the number of the slave is two, but may be more than two.

FIG. **2** is a view schematically showing a configuration of the flash **100** in FIG. **1**.

In FIG. **2**, the flash **100** includes an operation display unit **101**, a lighting circuit **102**, a flash control unit **103**, an interface **104**, and a wireless communication unit **105**.

The flash control unit **103** is constructed of a CPU, a ROM, a RAM, and the like, and controls the entire flash **100**. The flash **100** is controlled by the operation display unit **101** issuing an operation instruction to the flash control unit **103**.

The lighting circuit **102** performs control related to light emission such as charging and light emission control, specifically performs light emission control by receiving a signal from the flash control unit **103** representing a light emission command and also transmits a signal representing charge completion to the flash control unit **103**. The interface **104** operates as an interface for physically connecting to the camera **200** (FIG. **1**). Communication with the camera **200** is performed via the interface **104**.

The wireless communication unit **105**, as a communication unit capable of performing bidirectional communication, per-

forms wireless communication, and includes an antenna **105**A, a wireless control unit **105**B, an oscillation circuit **105**C, and a crystal oscillator **105**D.

The wireless communication unit **105** includes two modes, one of which is a type of the wireless communication unit **105** being embedded in the flash **100**, and the other of which is a removable type of the wireless communication unit **105** being formed into a card with a card slot formed in the flash **100**. The embedded type will be described in the present embodiment.

The antenna **105**A transmits/receives data using wireless communication, and transmits data received from a communication counterpart to the wireless control unit **105**B, and also receives data from the wireless control unit **105**B and transmits the data to the communication counterpart.

The oscillation circuit **105**C shapes the waveform of a clock signal generated by the crystal oscillator **105**D connected to the oscillation circuit **105**C, and outputs the shaped clock signal to each circuit of the wireless communication unit **105**, which enables the each circuit to be synchronized.

FIG. **3** is a flowchart showing the procedure of a camera control process implemented by the camera **200** in FIG. **1**.

This process is implemented by a CPU mounted in the camera **200**.

In FIG. **3**, when a shooting preparation start button on the operation display unit **201** is pressed by a user (step S**101**), the camera **200** transitions to a shooting preparation start state. That is, an instruction for carrying out shooting is input by the user.

Next, a shooting preparation start notification is issued to the master (step S**102**), which allows the camera **200** to transition to a waiting state for reception of a shooting enabled notification. The camera **200** never shoots when it is in the waiting state for reception of the shooting enabled notification.

When the shooting enabled notification is received from the master (YES to step S**103**), an enable flag for receiving pressing of a camera shooting start button is turned on (step S**104**), which allows the camera **200** to transition to a receiving state for pressing of the camera shooting start button. The camera **200** never shoots so long as it is not ready for receiving the camera shooting start button even if the camera shooting start button is pressed,

Next, when the shooting start button on the operation display unit **201** is pressed by the user (step S**105**) and the shooting enabled notification is received from the master (YES to step S**106**), the shooting is carried out (step S**107**), followed by the process being terminated. As described, the shooting is carried out when the shooting enabled notification is received; accordingly, it is possible to prevent a failure in light emission control of the flash caused due to interference of communication.

FIG. **4** is a flowchart showing the procedure of a master control process implemented by the master flash **100**A in FIG. **1**.

This process is implemented by the CPU mounted on the flash control unit **103**.

In FIG. **4**, when the shooting preparation start notification of indicating that the shooting preparation is started is received from the camera **200** (step S**201**), it is determined whether or not the master is communicating with the slave (step S**202**).

As a result of the determination of the step S**202**, when the master is not communicating with the slave (NO to the step S**202**), it is determined whether or not the charging of the slave is completed (step S**203**). The slave regularly issues charge completion notifications to the master. When the master receives the notification, it holds information of indicating that the charging of the slave is completed, and hence the above-mentioned determination can be performed using this information. Moreover, determining whether or not the charging of the slave is completed corresponds to determining whether or not the slave is ready for lighting.

As a result of the determination of the step S**203**, when the charging of the slave is not completed (NO to the step S**203**), a slave charge completion information is requested to the slave (step S**204**), followed by repeating the process of the step S**202** and the following steps.

On the other hand, as a result of the determination of the step S**203**, when the charging of the slave is completed (YES to the step S**203**), a communication disabled notification of instructing the slave not to transmit the information is issued, and also a shooting enabled notification of indicating that the shooting can be carried out is issued to the camera **200** (step S**205**), followed by the process being terminated.

According to the process of FIG. **4**, when the notification regarding the start of shooting preparation is issued by the camera **200**, in a case where the master and the slave are not communicating with each other (NO to the step S**202**) when the charging of the slave is completed (YES to the step S**203**), the slave is instructed not to transmit the information, and also the shooting enabled notification of indicating that the shooting can be carried out is issued to the camera **200** (step S**205**). That is, the camera **200** is prohibited to shoot until the slave is determined to become ready for lighting, and when it is determined that the slave becomes ready for lighting, the shooting enabled notification is issued to the camera **200** which is being prohibited to shoot. As a result, it is possible to prevent a failure in the light emission control due to communication between the lighting devices

FIG. **5** is a flowchart showing the procedure of a slave control process implemented by the slave flashes **100**B and **100**C in FIG. **1**.

This process is implemented by the CPU mounted on the flash control unit **103**.

In FIG. **5**, when the communication disabled notification is received from the master (step S**301**), a charge completion communication enable flag, indicating whether or not transmission of the information regarding the charge completion to the master is enabled, is turned off (step S**302**), followed by the process being terminated.

According to the process of FIG. **5**, transmission of the information from the slave is not performed after the shooting is enabled, which prevents interference of the communication between the master and the slave.

FIG. **6** is a flowchart showing the procedure of a charge completion check process implemented by the slave flashes **100**B and **100**C in FIG. **1**.

This process is implemented by the CPU mounted on the flash control unit **103**. Also, this charge completion check process is regularly implemented by the slave.

In FIG. **6**, when a charge completion check is performed (step S**401**) and the charge state is changed to the charge completion (step S**402**), it is determined whether or not the charge completion communication enable flag is turned on (step S**403**).

As a result of the determination of the step S**403**, when the charge completion communication enable flag is on (YES to the step S**403**), the charge completion is notified to the master (step S**404**), followed by the process being terminated, whereas when the charge completion communication enable flag is off (NO to the step S**403**), the process is immediately

terminated. Thus, when the communication disabled notification is received, the notification of step S**404** is prohibited (skipped).

According to the process f FIG. **6**, when the charge completion notification enable flag is off, the transmission of the information from the slave to the master is not performed, which prevents interference of the communication between the master and the slave.

According to the embodiment described above, it is possible to realize the bidirectional communication between the master and the slave except when the shooting is enabled, whereas transmission of the information from the slave is not performed when the shooting is enabled, thereby preventing interference of the communication between the master and the slave, which prevents a failure in the light emission control for the flash.

Aspects of the present invention can also be realized by a computer of a system or apparatus (or devices such as a CPU or MPU) that reads out and executes a program recorded on a memory device to perform the functions of the above-described embodiment, and by a method, the steps of which are performed by a computer of a system or apparatus by, for example, reading out and executing a program recorded on a memory device to perform the functions of the above-described embodiment. For this purpose, the program is provided to the computer for example via a network or from a recording medium of various types serving as the memory device (e.g., computer-readable medium).

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all modifications, equivalent structures and functions.

For example, in the embodiment described above, the master flash issues a notification of the shooting by the camera is enabled or a notification of the communication from the slave flash is prohibited, but the present invention may also be applied to a communication device that is connected to the camera and that does not include a lighting circuit. Such a configuration can prevent a failure in the lighting control caused due to communication between the communication device and the lighting device.

This application claims the benefit of Japanese Applications No. 2011-255053, filed Nov. 22, 2011, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. A communication device, capable of connecting to an image pickup device, wherein the communications device transmits a lighting instruction from the image pickup device to an external lighting device through a communication unit capable of performing bidirectional communication, comprising:

a determining unit configured to determine whether or not the external lighting device is ready for lighting; and

a control unit configured to control the external lighting device and the connected image pickup device,

wherein the control unit prevents the external lighting device from transmitting information to the communication unit when the external lighting device is ready for lighting, and

wherein the determining unit is implemented at least in part by a processor executing at least one program recorded on a non-transitory memory device.

2. The communication device as claimed in claim **1**, wherein the control unit inhibits the connected image pickup device from shooting until the external lighting device becomes ready for lighting, when the external lighting device is not ready for lighting.

3. The communication device as claimed in claim **1**, wherein the control unit inhibits the connected image pickup device from shooting until the external lighting device becomes ready for lighting, when the image pickup device is in a mode of performing the lighting instruction to the external lighting device in connection to shooting.

4. The communication device as claimed in claim **3**, wherein the control unit inhibits the connected image pickup device from shooting until the external lighting device becomes ready for lighting, even if the connected image pickup device receives an instruction of a user causing the connected image pickup device to shoot.

5. The communication device as claimed in claim **1**, wherein the control unit instructs the connected image pickup device to be ready for inhibiting shooting until the external lighting device becomes ready for lighting, when the external lighting device is not ready for lighting.

6. The communication device as claimed in claim **1**, wherein the control unit instructs the connected image pickup device to be ready for shooting, when the external lighting device is ready for lighting.

7. The communication device as claimed in claim **1**, wherein the determining unit determines whether or not the external lighting device is ready for lighting, based on information representing a charging state transmitted from the external lighting device to the communication unit.

8. The communication device as claimed in claim **7**, wherein the determining unit determines that the external lighting device is ready for lighting when the information representing the charging state indicates that the charge is completed, and determines that the external lighting device is not ready for lighting when the information representing the charging state indicates that the charge is not completed.

9. The communication device as claimed in claim **7**, wherein the determining unit repeatedly determines whether or not the lighting device is ready for lighting, until the external lighting device becomes ready for lighting.

10. A control method of a communication device, capable of connecting to an image pickup device, wherein the communications device transmits a lighting instruction from the image pickup device to an external lighting device through a communication unit capable of bidirectional communication, the control method comprising:

determining whether or not the external lighting device is ready for lighting; and

controlling the external lighting device and the connected image pickup device,

wherein controlling the external lighting device comprises preventing the external lighting device from transmitting information to the communication unit when the external lighting device is ready for lighting.

11. An apparatus, comprising:

an interface configured to connect to an image pickup device;

a lighting circuit;

a wireless communication unit configured to communicate with a lighting device; and

a control unit connected to the interface, the lighting circuit, and the wireless communication unit, the control unit being configured to disable communication with the lighting device when the lighting device is ready for lighting.

12. The apparatus of claim 11, wherein the control unit disables communication with the lighting device by preventing the lighting device from transmitting information to the wireless communication unit.

13. The apparatus of claim 12, wherein the control unit prevents the lighting device from transmitting information to the wireless communication unit by issuing a communication disable notification to the lighting device.

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